

REMARKS

This is intended as a full and complete response to the Final Rejection dated February 9, 2006, having a shortened statutory period for response set to expire on May 9, 2006.

CLAIMS

REJECTION UNDER 35 U.S.C. § 102

Claims 11 and 13 stand rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent No. 5,250,871 to Driscoll et al (*Driscoll*).

Driscoll discloses a quad compensated clock comprising four oscillator crystals electrically connected in series and with their sensitivity vectors aligned, nominally one per quadrant, in a common plane. The crystals are configured pairs so that maximum acceleration vectors of the oscillators comprising the pairs are in opposite directions. Outputs from the crystals are input into an oscillator circuit to form a quad compensated clock output with reduced sensitivity to acceleration. *Driscoll* does not teach correction of the clock output for any variations in crystal properties. *Driscoll* does not teach any structure such as a quad compensated temperature sensor or a processor cooperating with the clock as means for making corrections to the clock output.

The instant invention teaches a quad compensated clock comprising a quad compensated resonator comprising four oscillator crystals that are electrically connected in series with their acceleration sensitivity vectors aligned, nominally one per quadrant, in a common plane. The crystals are configured in pairs so that maximum acceleration sensitivity vectors of oscillators comprising the pairs are in opposite directions. Oscillator circuitry cooperates with the quad compensated resonator. Outputs of the oscillator crystals in the quad compensated resonator are combined and input into oscillator circuitry to form a quad compensated clock output with reduced sensitivity to acceleration. During a predetermined time interval "J" (see specification page 13 line 13 following), the quad compensated clock output is combined with output from a quad compensated temperature sensor using a compensation algorithm. The compensation algorithm is resident in a processor cooperating with the clock, and is used to correct the compensated clock output for variations in crystal properties.

Regarding claim 11, the Examiner states at 3a of the subject office action:

"The examiner considers the limitations contained in (d) [of claim 11 as amended in the previous office action response filed on 15 November 2005] to be an intended use that does not create any additional structural limitation on the quad clock, and further, that both a quad compensated temperature sensor and a processor cooperating with said clock does not appear to be positively claimed."

Claim 11 has been amended to specifically recite and thereby positively claim a quad compensated temperature sensor at element (c), and a processor at element (d). Claim 11 is now clearly distinguished over *Driscoll*. Claim 13, which depends on claim 11, is now also clearly distinguished over *Driscoll*.

In view of amended claim 11 and the discussion above, the Examiner is respectfully requested to reconsider rejection of claims 11 and 13 under 35 U.S.C. § 102(a) as being anticipated by *Driscoll*.

REJECTION UNDER 35 U.S.C. § 103

Claim 12 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Driscoll* in view of applicant's admission.

As discussed above, *Driscoll* does not teach or suggest a processor and a compensation algorithm for compensating clock output for variations in crystal properties. As discussed above, amended claim 11 is patentable over *Driscoll*. Claims 12, which depend upon claim 11, is now also patentable over *Driscoll* in view of applicant's own admission. The Examiner is respectfully requested to reconsider rejection of claim 12 under 35 U.S.C. § 103(a).

Claim 14 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Driscoll* in view of Application US 2002/0060952 A1 to Cecconi (*Cecconi*).

Driscoll discloses a quad compensated clock comprising four oscillator crystals electrically connected in series and with their sensitivity vectors aligned, nominally one per quadrant, in a common plane. *Driscoll* does not teach correction of the clock output for any variations in crystal properties other than those induced by acceleration. *Driscoll* discloses no type of temperature measuring apparatus or methodology.

Cecconi discloses a borehole seismic system. The *Cecconi* system includes a downhole clock comprising a quartz crystal. In order to minimize clock drift, the clock cooperates with a temperature control means (heating or alternately cooling). Both the quartz crystal and the temperature control means are disposed within thermal insulation. This methodology is used to maintain the quartz crystal at a constant temperature while operating in a borehole, therefore minimizing temperature induced clock output drift. Stated another way, *Cecconi* teaches temperature control rather than temperature compensation.

As discussed previously, the instant invention uses a measure of temperature in correcting clock output for variations in a plurality of crystal properties. No temperature control means is taught or needed to correct clock output for adverse effects of temperature variations. The correction process of the instant invention does, however, use a measure directly related to temperature. The quad compensated clock output is combined with output from a quad compensated temperature sensor using a compensation algorithm, resident in a processor cooperating with the clock, to correct the compensated clock output for variations in crystal properties. In view of previous discussion, amended claim 11 is now clearly distinguished over *Driscoll*. No combination of *Driscoll* and *Cecconi* teaches or suggests a system that uses a measure of temperature to correct clock output for temperature variations of crystal properties.

In view of the above discussion, amended claim 11 is patentable over *Driscoll* in view of *Cecconi*. Claim 14, which depends upon claim 11, is also patentable over *Driscoll* in view of *Cecconi*. The Examiner is respectfully requested to reconsider the rejection of claim 14 under 35 U.S.C. § 103(a).

Claim 22 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Driscoll* in view of U.S. Patent No. 4,633,422 to Brauer (*Brauer*).

Driscoll does not teach the use of an ensemble of quad compensated clocks. The Examiner states that mere duplication of parts is not sufficient to patentably distinguish any invention over prior art. See MPEP § 2144.44(VI)(B). Claim 22 has been amended to recite at element (d) the steps of combining outputs from each quad compensated clock thereby correcting the quad compensated clock outputs for changes in response properties of the crystals. No mere duplication of parts of *Driscoll* would suggest means or methods for performing this step. Amended claim 22 is now patentable over *Driscoll*.

Brauer teaches an apparatus and method for compensating for variations in oscillator output due to crystal aging. Aging is the only crystal property variation addressed by *Brauer*. No combination of *Driscoll* and *Brauer* teaches or suggests correction for a crystal property (i.e. aging) using the methodology recited in amended claim 22. Furthermore, crystal properties (and the correction thereof) as addressed by the instant invention include crystal hysteresis, crystal warm-up, and crystal short-term and long-term frequency stability in addition to crystal aging. No combination of *Driscoll* and *Brauer* would teach or even suggest apparatus and methods for correcting for crystal hysteresis, crystal warm-up, and crystal short-term and long-term frequency stability. Amended claim 22 is patentable over *Driscoll* in view of *Brauer*. The Examiner is respectfully requested to reconsider the rejection of claim 22 under 35 U.S.C. § 103(a).

ALLOWED CLAIMS

Applicant gratefully acknowledges the allowance of claims 23-35.

SUMMARY

The Examiner is respectfully requested enter this amendment, and further respectfully requested to allow claims 11-14, and 22 in view of the claim amendments and discussion.